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ABSTRACT

This study investigated the effects of "signals" in text (headings, previews, and logical connectives) on the reading comprehension of learners of English as a Second Language. Subjects were 232 female Hong Kong secondary school students, all less-skilled readers of English. The subjects read a relatively difficult passage in English on an unfamiliar topic, then were administered a factual test on five main ideas in the text, including five inference questions. Results suggest that headings and previews improved factual comprehension at the level of superordinate ideas, but logical connectives showed insignificant effects for both factual and inferential comprehension. No significant effects were found for inferencing for any of the signal types. Further study of this lack of effect is recommended. Four appendixes contain the original passage, the passage with signals, comprehension questions, and five tables. Contains 37 references. (MSE)

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EFFECTS OF SIGNALLING ON READING COMPREHENSION

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EFFECTS OF SIGNALLING ON READING COMPREHENSION

Icy K.B. Lee

Introduction

In the area of text processing there are a number of studies which have focused on a group of metadiscoursal words and phrases that are called "signals". Signals are structural cues that specify the interrelationships among items of information which compose the text and indicate the subordination and coordination of this information (Meyer 1984a:117). They are thought to indicate to readers the importance of ideas in a text, thus facilitating comprehension. The present study investigates the effects of headings, previews, and logical connectives on secondary ESL (English as a second language) students' comprehension of expository prose. Headings are short phrases that announce superordinate content (main ideas) before the reader encounters the actual content. Previews are phrases or sentences that announce superordinate content and relationships among superordinate content before the reader encounters them. Logical connectives are words or phrases that interrelate superordinate or subordinate content (details) to content of similar or different hierarchical levels (Spyridakis and Standal 1986). Since the majority of Hong Kong secondary students are not skilled readers, if consistent effects for signals are established, methods can be found to help these less skilled readers with their reading. Moreover, texts can be written with thoughtful inclusion of signals to facilitate ESL readers' reading comprehension, not just in the English language subject, but also in other content subjects taught in English.

Various signal types have been identified in reading research, such as headings, titles, previews, topic sentences, conjunctions, logical connectives and pointer words. Some studies have examined the effects of single signal types (e.g. Hartley and Trueman 1983, Klare, Shuford and Nichols 1958) while some have examined multiple signals in combination (e.g. Loman and Mayer 1983, Meyer 1975, Walker and Meyer 1980). Insignificant effects were found for structural cues, previews, summary statements and pointer words on recall of expository prose (Britton, Glynn, Meyer and Penland 1982, Meyer 1975, Meyer, Brandt and Bluth 1980). The inadequacy of recall, pointed out by Loman and Mayer (1983), lies in the fact that it only measures the overall amount recalled, hence a quantitative approach. In their study, Loman and Mayer use a qualitative approach which measures the quality of recall. Results show that headings, previews, and logical connectives help both good and poor readers recall conceptual ideas and aid creative problem solving, i.e. inferencing. It is concluded that signals would have greatest effects for unfamiliar technical or scientific prose (Loman and Mayer 1983:410). Kintsch and Yarbrough (1982) also adopt a qualitative approach to measure the effects of signals, using cloze and direct questions, and significant effects were found for signals in combination. Previews were shown to help good readers especially in comprehending longer, difficult and unfamiliar texts (Spyridakis and Standal 1986). Evidence of the significant effects of headings, previews, and logical connectives

on comprehension of details and inferencing is available in Spyridakis and Standal (1987 and 1989b), but such facilitation seemed to depend on text length and text difficulty. That is, signals would have clearest effects when the texts were neither too easy nor too difficult (Spyridakis and Standal 1987). Previews were found to be more helpful than logical connectives overall (Syprdiakis and Standal 1989b). Also each signal type individually was found to aid readers' comprehension more than any two in combination, e.g. headings are most helpful when they are alone (Spyridakis and Standal 1989b).

Although we still cannot find conclusive evidence for the effects of signals, certain important points have emerged from previous studies. Previous research on signals has indicated that if a text is syntactically or lexically quite difficult, the reader may benefit by the presence of signals. If a text is easy, on the other hand, readers will not benefit from signals because they simply do not need help from them. Neither would readers benefit from signals if the text is extremely difficult because they "may cause overloading of the subject's processing system and cause complete or near-complete breakdown of the comprehension process" (Afflerbach and Johnston 1984:314). Furthermore, signals seem to aid readers best when the topic of the text is unfamiliar (Loman and Mayer 1983, Spyridakis and Standal 1986, 1987, Spyridakis 1989a, 1989b).

The present study continues the previous line of research and examines both the individual and combined effects of headings, previews and logical connectives, using a relatively difficult passage on an unfamiliar topic. The research question addressed is: would signals benefit less skilled ESL readers in comprehending relatively difficult expository texts at the superordinate level (i.e. main ideas), and how? Since signals have been found to help readers identify superordinate content (Spyridakis 1989b), the present study mainly concentrates on comprehension of superordinate content and inferencing made from it. The construct "comprehension" is operationally defined in terms of the comprehension test scores. There are two dependent variables: (1) factual comprehension and (2) inferential comprehension. The independent variables are the three signal types that are investigated in the study.

The study, however, differs from the previous studies in a number of ways. First of all, the majority of these signalling studies were conducted with first language students, but this study investigates the effects of signals on some ESL learners' reading comprehension. Secondly, while most signalling studies have used good comprehenders studying in colleges, the subjects in this study are secondary students identified as less skilled readers. Thirdly, technical prose, which has often been used in previous studies, is not used in the present study because it will be too difficult for Hong Kong secondary students and will probably be at their frustrational level of reading. Instead, a non-technical expository text is used. Finally, instead of a recall test, multiple-choice test or forced-choice test, a comprehension test requiring written answers from students is used, which, it might be argued, is a more direct measure of comprehension. It is also a qualitative approach which allows one to examine and analyze the answers in greater depth.

Method

Subjects

Altogether 285 female S4 (secondary four, i.e. Grade 10) students, aged between 15-17, took part in the study. They are from three well-established girls' schools in Hong Kong with Band 1 to Band 3 intake at S1 (Grade 7) (altogether there are 5 bands, Band 1 being the best). The "less skilled readers" were selected from the weakest classes in the three schools, where students were expected to get Grade D or E in English Language (Syllabus B) in the Hong Kong Certificate of Education Examination in S5 (Grade 11).

Materials

An expository passage on an unfamiliar topic was chosen for the study. The passage belongs to the discourse type "collection of descriptions" in Meyer's (1984c) classification, which refers to a text where "a number of attributes, specifics, or settings are given about a topic" (Meyer 1984b:123). It contains information about the various uses of the aeroplane, and it is the kind of passage students may encounter. However, the topic, namely general aviation, is quite unfamiliar to secondary students, and it is not covered in their content subjects such as Geography and Economics. In determining the difficulty level of this passage, expert opinions were sought from several experienced secondary English teachers, who read the passage and expressed similar views that the passage would be quite difficult, but not too difficult, for the ability group identified in the study. The passage is about 500 words, which would be considered a rather long passage by S4 (Grade 10) ESL students.

Passage Analysis

The superordinate content of the passage was identified by having two independent judges, an expatriate teacher trainer and a local school inspector listing the main ideas of the passage. The judges' analyses were similar. Since an agreed list of main ideas was needed for operational purposes in the research, minor differences were resolved in conference.

Passage Design

The non-signalled control passage was derived from the authentic passage on "General Aviation" (see Appendix 1) with all existing signals belonging to the categories of headings, previews and logical connectives deleted. Then, headings, previews and logical connectives were added to the passage, either singly or in combination to produce seven other versions of the passage. Altogether six headings

and six previews were added to the signalled passages to pre-announce the superordinate content. Twenty logical connectives, derived from Halliday and Hasan's (1976) list of conjunctive relations (e.g. *In fact, on the other hand, as a result, however,* etc.) were added to the signalled passages, placed among ideas at all levels to interrelate superordinate and subordinate ideas. The eight versions of the passages either had:

1 no signals;
2 headings only;
3 previews only;
4 logical connectives only;
5 headings and previews;
6 headings and logical connectives;
7 previews and logical connectives; or
8 headings, previews, and logical connectives.

The length of the passages ranged from 429 to 519 words. (See Appendix 2 for the signalled passage.) Three different readability tests, Flesch Reading Ease, Gunning's Fox Index and Flesch-Kincaid Grade level, were used to ensure that the eight versions of the passage were of comparable difficulty level. No significant differences were found. (Full details are reported in Lee 1993.)

Test Design

The test comprised a factual question asking about the five main ideas in the passage and five inferencing questions (see Appendix 3). These questions were designed to assess two types of information:

1 comprehension of superordinate content, and
2 inferences made from superordinate content in the passage.

Two other questions were asked before the comprehension test to obtain information about subjects' familiarity with the topic and their view of the difficulty level of the passage.

Procedure

The passage was pilot-tested twice with two different groups of students, where they were asked to rate the familiarity and difficulty level of the passage. The passage was found to be unfamiliar and relatively difficult. The test was then administered to the 285 subjects in a regular English lesson. Each subject was randomly assigned to read one of the eight versions of the passage. Subjects were given a set of materials, which included a cover page with simple instructions, one

passage, a question on topic familiarity, a question on passage difficulty and a comprehension test on the passage. Verbal instructions were given by the teacher before the test. Subjects were given 10 minutes to read the passage and answer the familiarity question and the difficulty question first. They were then given 25 minutes to answer the comprehension questions. They were allowed to refer back to the passage.

The tests were scored by two raters. Pearson Correlation Coefficients were calculated between the scores assigned by the two raters for each dependent measure. Very strong positive correlations were found for both the factual (0.9863) and inferential (0.97886) comprehension scores.

The test data were analyzed with SAS (Statistical Analysis System) statistical software for each dependent measure (factual comprehension and inferential comprehension scores), using the GLM (General Linear Models) Procedure. One-way ANOVAs were used to find out the single and combined effects of signals. Three-way ANOVA was used to investigate the main effects of signals and their interactions. A significance level of $p = .05$ was chosen.

Results

285 subjects participated in the study, but only 232 scores for each dependent measure were submitted for analysis. The scores of 53 subjects were removed from the data base, they were those who (a) indicated the content was not unfamiliar to them (39 subjects), (b) did not answer the familiarity question and/or difficulty question (9 subjects), and (c) indicated that the passage was very easy or easy (5 subjects).

The mean scores and standard deviations for the eight versions of the passage were calculated (see Table 1 in Appendix 4). The descriptive statistics indicate a general trend toward higher scores with the addition of signals for factual comprehension, particularly in passages where headings were added. However, the inferential comprehension scores for all the eight versions seemed to fall within a small range. If we examine the standard deviations, we can find that the dispersion of the factual comprehension scores was greater than that of the inferential comprehension scores.

Results of One-way ANOVA on individual signals showed insignificant effects for inferential comprehension. But there were significant results for headings ($p = .0039$) and previews ($p = 0.0120$) for factual comprehension (see Table 2 in Appendix 4).

Insignificant effects were also found for inferential comprehension for all the three versions of the passage containing two signal types. There were significant effects, however, for all the three versions of the passage for factual comprehension with headings and previews ($p = .0001$), headings and logical connectives ($p =$

.0111), and previews and logical connectives (p = .0444). In other words, there were significant combined effects for these signals (see Table 3 in Appendix 4).

Results of one-way ANOVA on the 3-crossed effect of headings, previews and logical connectives indicated insignificant results for inferencing, but there was significant effect (p = .0001) for factual comprehension. When one examines the results of the previous analyses, one can notice the highly significant effect of headings on factual comprehension. It may therefore be possible that the significant three-crossed effect (headings x previews x logical connectives) was due to the very predominant influence of headings (see Table 4 in Appendix 4).

Results of the 3-way ANOVA (headings x previews x logical connectives) (see Table 5 in Appendix 4) indicated main effects of headings and previews for factual comprehension. There was no interaction, however, between headings and previews, and there was no other interaction for the other signals.

Discussion

It is hypothesized that signals would aid comprehension at the superordinate level not only when they are alone but also when they are combined. The individual and combined effects of signals were tested in the study and analyzed in the factorial design. Two significant main effects were identified for individual signals in the statistical analyses. Headings and previews were found to improve factual comprehension at the level of superordinate ideas. There was, however, insignificant effect for logical connectives for both factual and inferential comprehension. No significant results were found for inferencing for any of the signal types. Of importance is that there was no significant signal interaction in the analyses. The fact that there was no interaction between headings and previews can be explained by the similarity of their functions, both of which serve to pre-announce superordinate content.

The significant results of headings and previews for factual comprehension are consistent with previous research findings. Since headings pre-announce the superordinate content before the readers encounter it, they help readers locate the superordinate ideas and relationships more easily, facilitating the comprehension process. The influence of previews on factual comprehension could be explained by the selective attention and memory activation hypotheses put forward by Glover, Dinnel, Halpain, McKee, Corkill and Wise (1988). That is, previews selectively guide readers' attention and help their memory activation. Like headings, previews can help readers build a strong hierarchical framework in memory from which comprehension of superordinate content is enhanced.

However, the significant effects of headings and previews on factual comprehension demonstrated in this study may have been due to other reasons. First of all, headings and previews might be particularly helpful to students reading this text because of its "list-like" nature (i.e. "collection of descriptions" type). Since the

passage was a collection of ideas about the uses of general aviation, with the headings and previews virtually summarising the main points, students were able to get the superordinate ideas from the headings and previews quite easily. The greater influence of headings than previews on factual comprehension might have been due to the specific question in the test. It could be possible that the question which asked subjects to list *the* five main uses of general aviation in the passage had led students (who were reading a passage with headings) to look for the clues in the headings. Also headings might have helped comprehension better than previews because they attracted attention more easily, being short phrases added to the passage and being underlined, and hence more striking visually. In brief, headings might have been the best aid to comprehension because of the clouding effects of the text type and question type.

The insignificant effect of logical connectives in the study is consistent with the findings in Spyridakis and Standal (1986), who have attributed the result to the fact that logical connectives did not support or summon the readers' structure strategy when they were reading a relatively difficult passage. This explanation is highly plausible in the present study, where students were also reading a relatively difficult passage. Another possible explanation for the result is that since logical connectives were added at many levels of the passage (unlike headings and previews, which were added at the superordinate level only), readers might have been distracted by those logical connectives that emphasized subordinate information and relationships when they were building a hierarchical representation of the text in memory (Spyridakis 1989b, 408).

Apart from these reasons, it may be possible that logical connectives in the passages were simply not heeded by the subjects. Allison has pointed out that explicit signals of relations in a discourse are often not heeded by text receivers (Allison 1991:378). A number of studies have reported that ESL readers have difficulties handling cohesive links (Cohen et al. 1979; Dubin and Olshtain 1980). The insignificant results of logical connectives may have been due to the fact that students in the study simply ignored the logical connectives when they encountered them, or they misinterpreted them in the process of comprehension. Crewe (1990) has cited an example where a reader was reading "therefore" in the text and yet expecting "however". In such a case, the reader would simply overrule the original word and read "however". One could perhaps conclude that logical connectives did not aid comprehension because readers did not pay adequate attention to them, or they misconstrued some of the logical connectives in the comprehension process.

Related to the above is the observation that logical connectives did not help students of this particular standard. Geva's (1992) study on conjunctions with L2 learners shows that L2 learners improve their ability to utilize and infer logical relationships in extended discourse as they grow in their L2 proficiency. Grabe also points out that there is a language proficiency threshold below which comprehension processes used in L1 reading are not used as effectively in L2 reading, and therefore language proficiency plays a crucial role in second language reading abilities (Grabe 1991:391). Given the students' standard of English, the

logical connectives used in the study, which were of a fairly wide range (19 different logical connectives altogether), would probably be beyond their capability.

In addition to the wide range of logical connectives is their density in the passage. The insignificant result may have been caused by the fact that there were too many logical connectives in the passage. Altogether 20 logical connectives were added to the text. Just as under-signalling is detrimental to comprehension (see Hoey 1983), so it may be that over-signalling too may hinder comprehension. Morgan and Seller (1980) and Carrell (1982) argue that cohesive devices do not themselves contribute to coherence, but are interpreted through the readers' understanding of "content coherence." Coupland (1984) has talked of the "optimum level" of explicit signalling. Allison suggests that above the "optimum level", further cohesive ties will become irksome and counter-productive, while below it, the absence of explicit ties can interfere with comprehension (Allison 1991:378). If it is true that some logical connectives were actually not needed in the text, their presence would probably not aid comprehension, or might even impede comprehension. Thus, the number of logical connectives may have contributed to the insignificant result.

Finally, that logical connectives did not benefit comprehension may be due to the kind of reading strategy that students in the study employed. It has been argued that younger and less proficient students use fewer strategies and use them less effectively in their reading comprehension (Garner 1987, Nist and Mealey 1991, Padron and Waxman 1988). This is generally true of Hong Kong ESL readers, who pay too much attention to subordinate details, are very word-bound and inefficient in bottom-up processing, because they attend predominantly to the graphic form. The insignificant results of logical connectives could be explained by the fact that students did not use effective strategies to help comprehension. For example, they might not know how to make use of "selective attention", which is a kind of metacognitive strategy where students pay more heed to some features of the text, such as logical connectives in the study to enhance comprehension.

While headings and previews were found to benefit factual comprehension, none of the signals seemed to have an effect on inferential comprehension. Although some previous signalling studies have found significant results for inferencing, they have failed to provide a sound theoretical framework within which to explain the relationship between signals and inferencing. It seems reasonable to conclude from the study that signals do not aid inferencing. It could be argued that if signals highlight certain elements in the text and indicate the organization of the text, they cannot possibly help inferencing. Two further comments about signals and inferencing seem in order here. Firstly, signals tell us what is there in a text, whereas inference involves what is not there. Secondly, no attempt was made in the study to select signals, namely logical connectives which would focus attention on inferred information.

On the other hand, it is possible that signals could help inferencing, but then the so-called "floor effect" of the inferencing questions contributed to the insignificant result. What the floor effect means is that the test was not able to measure the

entire range of achievement possible, where signals might have its influence. This is possible because the students in this study were not skilled readers and they might have found the inferential test so difficult that even the presence of signals did not help. As a result, they scored close to the minimum score, i.e. the "floor" of the test. This floor effect could be observed from the descriptive statistics. The mean score for inferential comprehension was far below 50% of the maximum mark. The standard deviation was about 1.95, indicating a small dispersion among the scores. This explanation, however, could be rejected on the grounds that if the hypothesis about signals was correct, even poor inferencing skills should be helped by signals.

As inferencing is an integral part of text comprehension, it would be useful to find out why students failed to infer. One reason why students did badly in inferencing is that although inferencing skill is not always difficult, it is frequently difficult in expository texts. According to O'Malley and Uhl Chamot (1990), inferencing is a kind of "cognitive strategy" which engages the readers in "interacting with the material to be learned, manipulating the material mentally or physically, or applying a special technique to a learning task" (O'Malley and Uhl Chamot 1990:138). In other words, inferencing as a cognitive strategy involves a number of cognitive skills, such as reasoning, logical thinking, and problem-solving. Another problem about inferencing is also that the existing curriculum in Hong Kong is not conducive to developing cognitive skills in students. Students are simply not sufficiently engaged in learning tasks where their cognitive thinking is encouraged and developed. As a result, a comprehension test that requires inferencing turns out to be very difficult for Hong Kong students. Moreover, it is a rather unfamiliar test format to them as the existing English language public examination for this level of students puts very little emphasis on the skill of inferencing.

A word of caution is necessary, however, in terms of generalizing the results externally. First of all, since the 285 subjects in the study are all female S4 students from three well-established English-medium schools in Hong Kong, identified as less skilled readers, the results of the study would thus be generalizable only to students of the same sex, of similar standards, backgrounds and school experiences. Secondly, only one passage was tested in the study, namely a non-technical prose passage about 500 words long, belonging to the text type "collection of descriptions". Hence, the results are not generalizable to other text types, texts of different lengths, and technical texts. Last but not least, since the study investigates headings, previews, and logical connectives only, the results could not be generalized to other signal types.

Nonetheless, the present research has demonstrated the value of including headings and previews in expository texts, which has significant implications for the design of reading materials for ESL readers. The inclusion of headings and previews in textbooks on content areas such as History and Geography would be particularly useful in helping students understand content knowledge taught through the medium of English. Although logical connectives in the study do not seem to

help comprehension, they are not yet a closed issue. It would be interesting to find out if logical connectives would aid comprehension in other text situations, and how the possible inclusion of logical connectives could help ESL readers' comprehension. Given the tendency among ESL learners to misuse and overuse logical connectives in writing, there is a great need to investigate the role of logical connectives in discourse, with a view to helping ESL learners with proper processing of logical connectives in text comprehension, and hence appropriate use of connectives in writing. On the other hand, further research is needed to investigate the role of signalling in inferencing, which is found to be totally inadequate and ineffective among ESL readers in the study. Also the fact that students are weak in inferencing is certainly a sound justification for more questions of this nature to be included in reading comprehension tests, not less. The present imbalance in the comprehension question types found in reading tests in Hong Kong needs to be addressed.

Although headings and previews appear to aid factual comprehension, no conclusive evidence can yet be drawn about the whole issue of signalling and ESL reading comprehension. It is hoped that subsequent research on the area of signalling and ESL text comprehension will yield more insights into the role of signals in discourse, so that useful information can be yielded to help materials designers with the writing of texts for ESL readers, and to help teachers with more effective teaching of reading.

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Appendix 1

General Aviation
(Original Passage)

The modern traveller usually thinks of aviation in terms of airline transport, and perhaps of military applications. But the numerous uses of planes that come under the heading "general aviation" are often less known.

One of the major roles of general aviation is in business. In fact, business flying has become one of the world's fastest growing industries in recent years. Forecasters say that business flying will continue to grow despite the energy and fuel shortages in many areas. In short-distance travel, small aircraft use less fuel than big airliners. And as airlines continue to reduce the number of flights to smaller communities because of light and uneconomic loads, businessmen will continue to turn to company planes to get them to the right place at the right time. In many countries, business planes are no longer used only for top company officials. They now transport managers, engineers, accountants and other specialists who are required to travel a lot.

Busy people are also becoming used to the idea of hiring planes or taking small aircraft to get them to their destination quickly. In fact, such services frequently connect with the major airlines. The result is a more complete network of air communications similar to that which developed in earlier years in land and sea transport.

In the broad category of special purpose flying, there are many uses of general aviation. In the field of air cargo, aircraft pick up and drop off loads of cattle, drilling equipment, road-building machinery and life-saving supplies. Various sizes and designs of "general aviation" aircraft are used throughout the world in such tasks as hurricane hunting, the location of dangerous icebergs and forest fire fighting. In recent years, there has been increased interest in flying sports such as gliding, manpowered flight and hang-gliding.

But these spectacular uses are only part of the story. General aviation in all of its forms now contributes thousands of interesting and highly skilled jobs to the

economies of the nations, with a growing number of small airports providing new trade and communication networks.

The recent development of the short take-off and landing aircraft (STOL) has boomed in general aviation. It paves the way to flights to many areas that have only short runways. The small community with an industrial airport can now compete on a more equal basis with big cities in attracting industries. In fact, the growth of general aviation will lead to decentralization in industries. Companies can be attracted to smaller population centres by their closeness to raw materials, by their lower land and operating costs, and by better living conditions for employees. General aviation makes it more convenient for remote communities to reach larger market centres.

If the past is any guide, man will continue to find new special uses for the aeroplane.

(From *Mastering English Precis and Language Practice*)

Appendix 2

General Aviation
(With Signals)

The modern traveller usually thinks of aviation in terms of airline transport, and perhaps of military applications. But the numerous uses of planes that come under the heading "general aviation" are often less known. *The various uses of general aviation will be discussed in this passage.*

Business Flying

One of the major roles of general aviation is in business. Business flying has become one of the world's fastest growing industries in recent years. In fact, forecasters say that business flying will continue to grow despite the energy and fuel shortages in many areas. One reason is that in short-distance travel, small aircraft use less fuel than big airliners. Also, as airlines continue to reduce the number of flights to smaller communities because of light and uneconomic loads, businessmen will continue to turn to company planes to get them to the right place at the right time. As a result, in many countries, business planes are no longer used only for top company officials. They now transport managers, engineers, accountants and other specialists who are required to travel a lot.

Busy People

Moreover, *general aviation offers a useful service to busy people*, who are becoming used to the idea of hiring planes or taking small aircraft in order to get them to their destination quickly. In fact, such services frequently connect with the major airlines. The result is a more complete network of air communications similar to that which developed in earlier years in land and sea transport.

Special Purpose Flying

In the broad category of special purpose flying, there are many uses of general aviation. For instance, in the field of air cargo, aircraft pick up and drop off loads of cattle, drilling equipment, road-building machinery and life-saving supplies. Besides, various sizes and designs of special purpose "general aviation" aircraft are used throughout the world in such tasks as hurricane hunting, the location of dangerous icebergs and forest fire fighting. Furthermore, in recent years, there has been increased interest in flying sports such as gliding, manpowered flight and hang-gliding.

General Aviation and Economy

General aviation has some bearing on the economy. General aviation in all of its forms now not only
contributes thousands of interesting and highly skilled jobs to the economies of the nations, but it also results
in a growing number of small airports providing new trade and communication networks.

General Aviation and Industries

General aviation contributes to the industries in a significant way. The recent development of the short take-off and landing aircraft (STOL) has boomed in general aviation. It thus paves the way to flights to many areas that have only short runways. Because of this the small community with an industrial airport can now compete on a more equal basis with big cities in attracting industries, which will therefore lead to decentralization in industries. In addition, companies can be attracted to smaller population centres by their closeness to raw materials, by their lower land and operating costs, and by better living conditions for employees. Thus, general aviation makes it more convenient for remote communities to reach larger market centres.

New uses

Last but not least, if the past is any guide, man will continue to find new special uses for the aeroplane.

Note: Headings are in **boldface** and underlined.
Previews are *italicized* and underlined (in normal face type and not underlined in actual tests).
Logical connectives are underlined (but not underlined in actual tests).

Appendix 3

Comprehension Questions

1. List the 5 uses of general aviation mentioned in the passage.

   a.

   b.

   c.

   d.

   e.

2. What are the advantages of small aircraft over airlines for business people?

3. Why is there now such a wide range of aircraft designs?

4. If the general aviation industry declined, what would the effect be on small communities?

5. What is the likely future of general aviation?

6. What do you understand by the term "general aviation"?

Appendix 4

Table 1

Mean Scores and Standard Deviations

	Mean Score	s.d.	No. Subjects
No Signals	4.20 F 3.27 I	2.78 F 2.10 I	30
Headings Only	6.84 F 3.36 I	3.37 F 1.87 I	22
Previews Only	6.50 F 3.02 I	3.09 F 1.72 I	27
Logical Connectives Only	4.85 F 2.55 I	2.44 F 1.98 I	30
Headings & Previews	7.70 F 3.38 I	3.54 F 2.26 I	30
Headings & Logical Connectives	6.30 F 3.03 I	3.30 F 1.49 I	35
Previews & Logical Connectives	5.93 F 2.78 I	3.33 F 2.39 I	30
Headings, Previews & Logical Connectives	8.09 F 3.39 I	2.46 F 1.87 I	28

F = factual comprehension
I = inferential comprehension

Table 2

Summary of Results for Individual Signals (p value)

Hypothesis	ANOVA Factual	ANOVA Inferential	MANOVA
Headings Only	.0039*	.7369	.0163*
Previews Only	.0120*	.6203	.0404*
Logical Connectives Only	.5460	.3873	.5812

* = $p < .05$

Table 3

Summary of Results for Two Signals in Combination (p value)

Hypothesis	One-Way ANOVA Factual	One-Way ANOVA Inferential	MANOVA
Headings & Previews	.0001*	.6231	.0003*
Headings & Logical Connectives	.0111*	.7661	.0403*
Previews & Logical Connectives	.0444*	.5147	.1175

* = $p < .05$

Table 4

Summary of Results for Three Signals in Combination (p value)

Hypothesis	One-Way ANOVA Factual	Inferential	MANOVA
Headings, Previews & Logical Connectives	.0001*	.6579	.0001*

* = $p < .05$

Table 5

Results of Three-way ANOVA (p value)

Main / Interaction Effects	F	I	MANOVA
Headings Only	.0001*	.1342	.0001*
Previews Only	.0002*	.7207	.0011*
Headings x Previews	.6491	.6993	.8324
Logical Connectives Only	.9663	.2167	.4670
Headings x Logical Connectives	.8843	.5442	.8212
Previews x Logical Connectives	.8592	.4219	.7121
Headings x Previews x Logical Connectives	.1846	.8945	.4094

F = factual comprehension
I = inferential comprehension
* = $p < .05$